CHAPTER I

INTRODUCTION

1.1 Background

In this case study the main point of this research is Friction Stir Welding (FSW) of aluminium to copper.The Friction Stir welding or FSW is a relatively new solid-state joining process. This joining technique is energy efficient, environment friendly, and versatile. In particular, it can be used to join high-strength aerospace aluminum alloys and other metallic alloys that are hard to weld by conventional fusion welding. FSW is considered to be the most significant development in metal joining in a decade.

Friction stir welding (FSW) technology as shown in Fig.1 is feasible to join dissimilar materials because of its solid state nature. Present article provides a comprehensive insight on dissimilar copper to aluminum materials joined by FSW technology. FSW parameters such as tool design, tool pin offset, rotational speed, welding speed, tool tilt angle, and position of workpiece material in fixture for dissimilar Cu–Al system are summarized in the present review article. Additionally, welding defects, microstructure, and intermetallic compound generation for Cu–Al FSW system have been also discussed in this article. Furthermore, the new developments and future scope of dissimilar Cu–Al FSW system have been addressed.

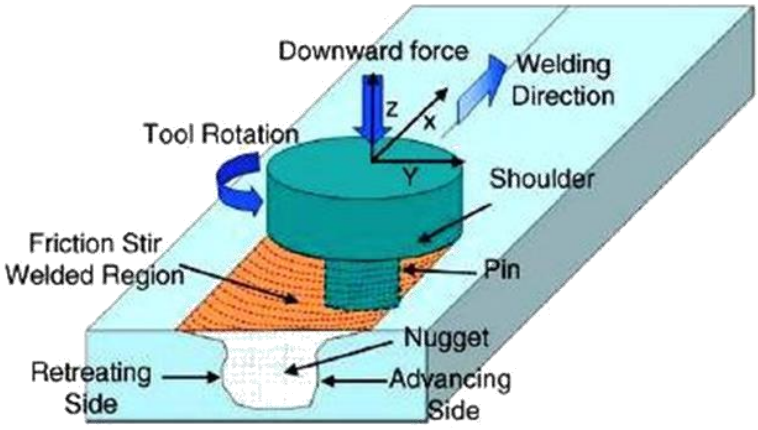

Figure 1 : Schematic diagram of friction stir welding

Copper–aluminium joints are inevitable for certain applications due to unique performances such as higher electric conductivity, heat conductivity, corrosion resistance and mechanical properties. Friction welding is the most common method used due to material and energy saving. In the present study, copper and aluminium materials were joined by friction welding. Optimum parameters were obtained using a statistical approach. Tensile and microhardness tests were applied to the joints.The joining of dissimilar materials is one of the most advanced topics. Friction stir welding (FSW) technology is feasible to join dissimilar materials because of its solid state nature. Present article provides a comprehensive insight on dissimilar copper to aluminum materials joined by FSW technology.

For a simple lap joint as shown in Fig. 2 (d), two lapped plates or sheets are clamped on a backing plate. A rotating tool is vertically plunged through the upper plate and into the lower plate and traversed along desired direction, joining the two plates.

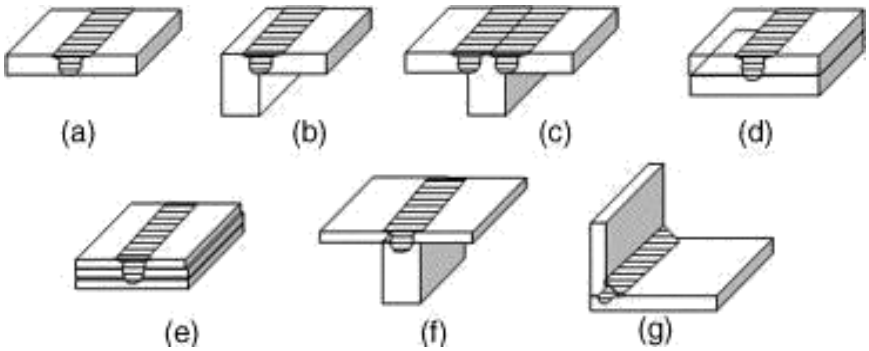

Figure 2 (a) square butt, (b) edge butt, (c) T butt joint, (d) lap joint, (e) multiple lap joint, (f) T lap joint, and (g) fillet joint. lap joint

1.2 Application of Joining Al to Cu

The applications of dissimilarly welded materials are numerous and depend on the properties of both joined materials. Cu is mostly applied where its conductive characteristics are needed, such as in electrical or heat transference. Al is a conductive material as well although its properties are not as ideal as for Cu. On the other hand, Al is a much cheaper material and therefore can be used to replace the Cu in applications where some sections do not need the full effect of the Cu characteristics.

1.3 Objective

The objectives of this experiment were to investigate the friction stir welding for dissimilar copper to aluminum material by lap joint.

As a result, the objectives of this presents study are as follows:

- Review and detail the current state of the art for FSW of Al-Cu joints.
- Review microhardness test of Al to Cu.
- Review a photomicro of Al-Cu

1.4 Scope of Study

The focus of the research work will be concentrated in the mechanical performance and the stir zone microstructure by FSW lap. All the testing of welded part will be lap welding joints.Lap welding joints are used most often to joint two pieces with differing thicknesses together. Also considered a fillet type, the weld can be made on one or both sides. A Lap Joint is formed when 2 pieces are placed in an over lapping pattern on top of each other.